Pneumatic Excavation Mechanism for Lunar Resource Utilization, Phase II

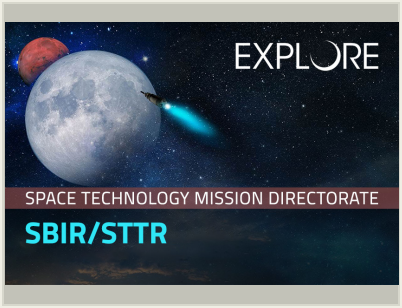
Completed Technology Project (2008 - 2010)

Project Introduction

Honeybee Robotics, in collaboration with Firestar Engineering, proposes to continue development of a pneumatic regolith excavating, moving and heating approach. With this additional maturity, this base technology will enable multiple applications in lunar surface operations. In particular: We propose to develop a prototype excavator for mining the top few centimeters to meter (via strip mining) of lunar regolith using pneumatics in an analogous jet-lift dredging method and excavating holes and trenches of various dimensions. This method uses a pulsed gas to draw adjacent material into a delivery pipe connected to a receiving container or exit tube for delivery over long distances. This work would continue development on the base technology of the pneumatic approach. We also propose to adapt the pneumatic system developed for mining to the task of regolith transfer. For example the pneumatic regolith transfer method could be used in place of an auger (which has a tendency to jam) to move the regolith from a hopper to an oxygen extraction plant. As another application of this pneumatic approach, we proposed to use dusty gas (regolith suspended in carrier gas feeding from a hopper to a processing plant) and heat it in a heat exchanger. The convective heat transfer (or even gaseous conduction) in granular material is much more effective than solid-solid conduction especially in vacuum where particle to particle conduction is minimal making a regolith four times better insulator than aerogel.

Anticipated Benefits

Potential NASA Commercial Applications: There is no terrestrial application for this system as it was actually derived from the earth-based methods.



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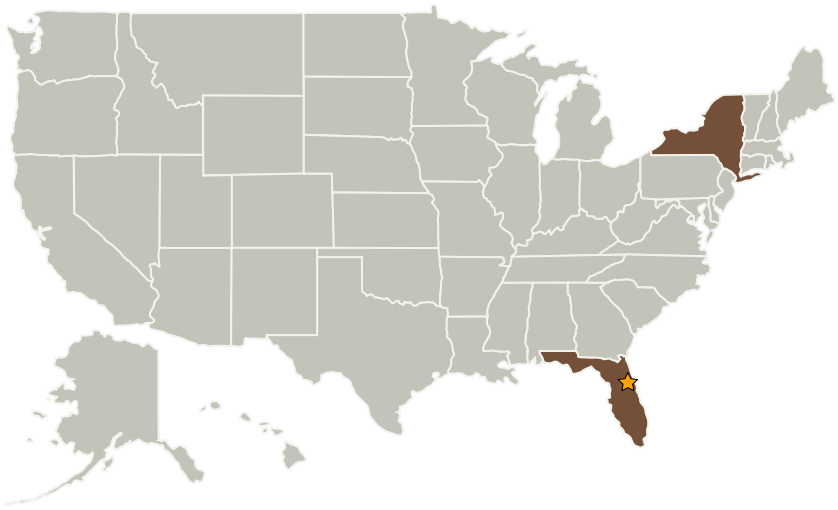
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Kennedy Space Center(KSC)	Lead Organization	NASA Center	Kennedy Space Center, Florida
Honeybee Robotics, Ltd.	Supporting Organization	Industry	Pasadena, California

Primary U.S. Work Locations	
Florida	New York

Project Transitions

January 2008: Project Start

January 2010: Closed out

Closeout Summary: Pneumatic Excavation Mechanism for Lunar Resource Utilization, Phase II Project Image

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Kennedy Space Center (KSC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

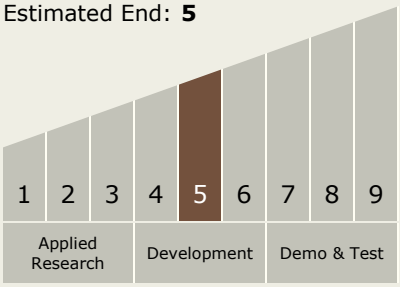
Carlos Torrez

Principal Investigator:

Kris Zacny

Technology Maturity (TRL)

Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.1 In-Situ Resource Utilization
    - TX07.1.2 Resource Acquisition, Isolation, and Preparation